

Installation Manual

P/N 20002298, Rev. C

September 2007

Micro Motion[®] F-Series Sensor

Installation Manual



Before You Begin

This manual describes how to install a Micro Motion® F-Series sensor. The following information is provided in this manual:

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Customer service

For technical assistance, phone the Micro Motion Customer Service department:

- In the U.S.A., phone **800-522-MASS** (800-522-6277) (toll free)
- In Canada and Latin America, phone +1 303-527-5200 (U.S.A.)
- In Asia:
 - In Japan, phone 3 5769-6803
 - In other locations, phone +65 6777-8211 (Singapore)
- In Europe:
 - In the U.K., phone 0870 240 1978 (toll-free)
 - In other locations, phone +31 (0) 318 495 555 (The Netherlands)

Customers outside the U.S.A. can also email Micro Motion customer service at *International.MMISupport@EmersonProcess.com*.

Troubleshooting

Refer to the transmitter configuration and use manual for troubleshooting help.

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Specifications

Full product specifications can be found in the F-Series Product Data Sheet, which is available from the Micro Motion web site at www.micromotion.com.

Definitions

The term *MVD™ transmitter* refers to the following transmitter models:

- Models 1500, 1700, 2500, and 2700
- Models 3500 and 3700

The term *high-temperature sensor* refers to the following F-Series models:

- F025A and F025B
- F050A and F050B
- F100A or F100B

The term *extreme high-temperature sensor* refer to the following F-Series models:

- F025C and F025E
- F050C and F050E
- F100C and F100E

European installations

This Micro Motion product complies with all applicable European directives when properly installed in accordance with the instructions in this manual. Refer to the EC declaration of conformity for directives that apply to this product.

The EC declaration of conformity, with all applicable European directives, and the complete *ATEX Installation Drawings and Instructions* are available on the internet at www.micromotion.com/atex or through your local Micro Motion support center.

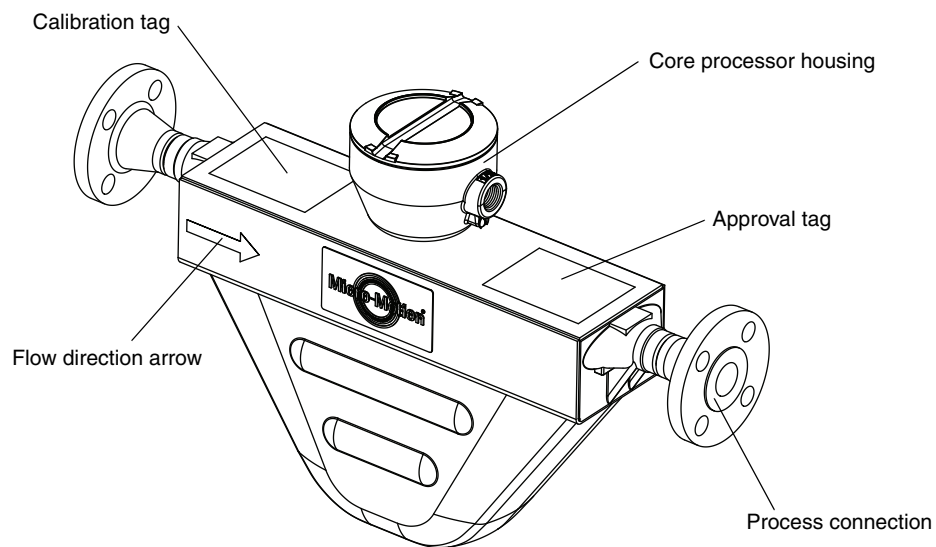
Information affixed to equipment that complies with the Pressure Equipment Directive can be found on the internet at www.micromotion.com/library.

Installation options

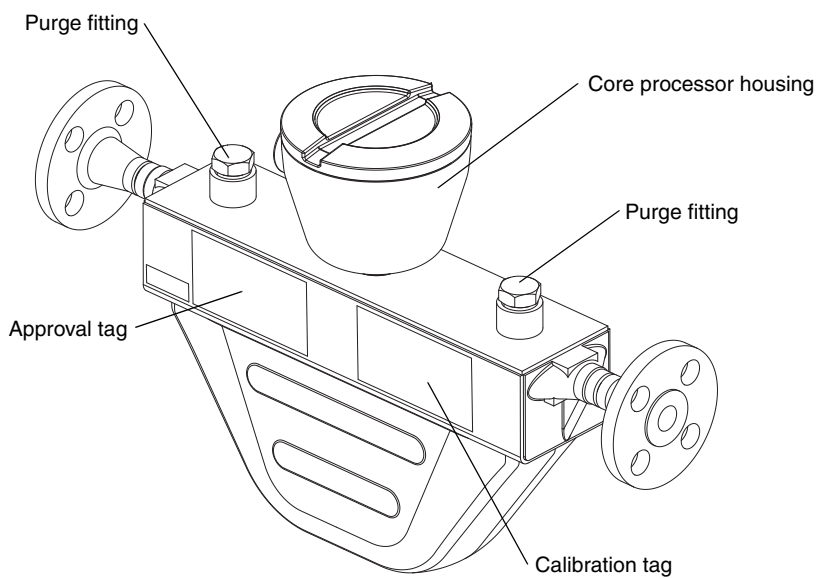
The F-Series sensor makes up one part of a Coriolis flowmeter. The other part is a transmitter. F-Series sensors are available with the following electronics interfaces:

- An integral core processor for connecting to a 4-wire remotely mounted transmitter or to a user-supplied remote host (Figure 1).
- An integral Model 1700 or 2700 transmitter (Figure 2).
- A 9-wire junction box for connecting to a remotely mounted transmitter or a remotely mounted core processor (Figure 3).
- An integrally mounted IFT9701 transmitter (Figure 4).
- High-temperature and extreme high-temperature models are equipped with a flexible conduit, on which can be mounted a Model 1700/2700 transmitter, a core processor, or a junction box (Figure 5).

Figure 1 F-Series sensor with core processor

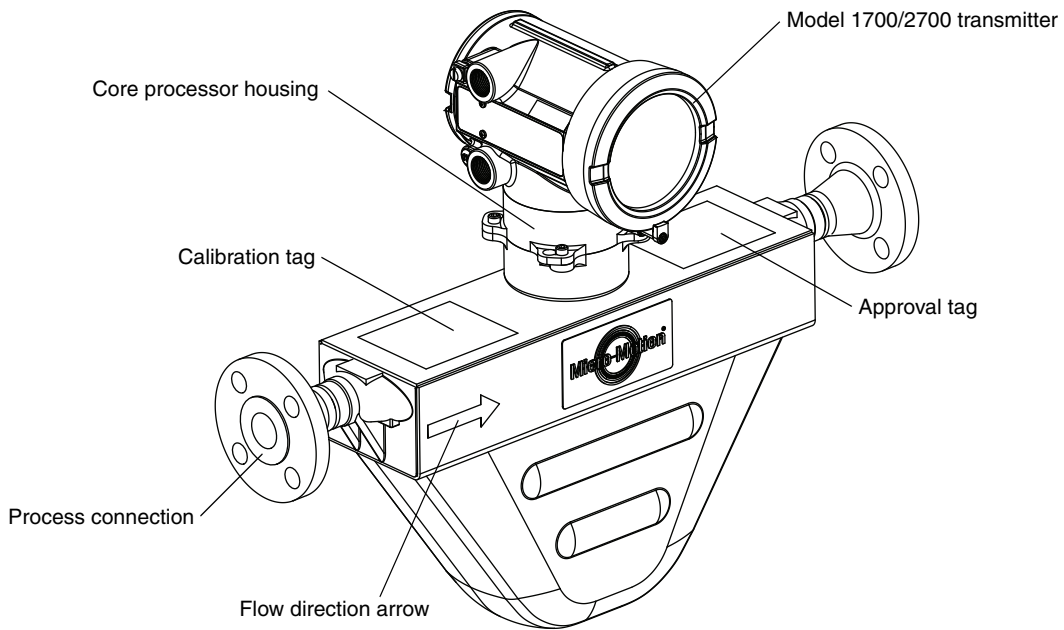


Sensor with purge fittings



Before You Begin

Figure 2 F-Series sensor with integrally mounted Model 1700/2700 transmitter



Sensor with purge fittings

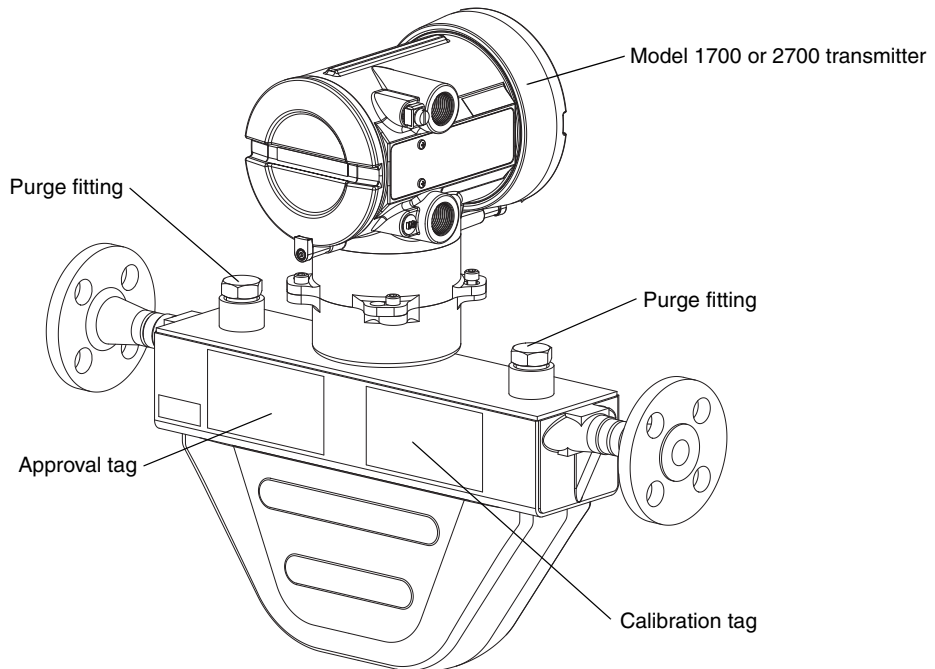
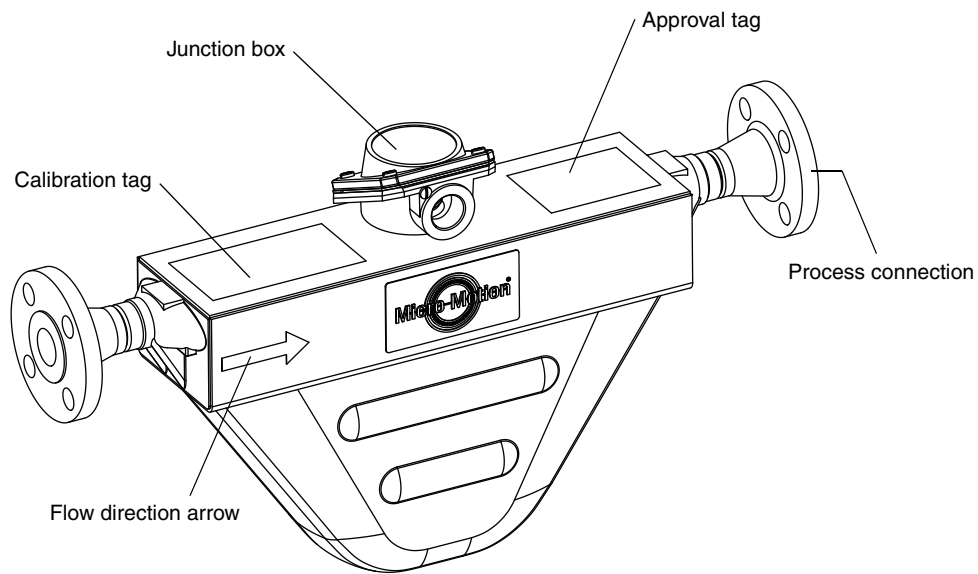
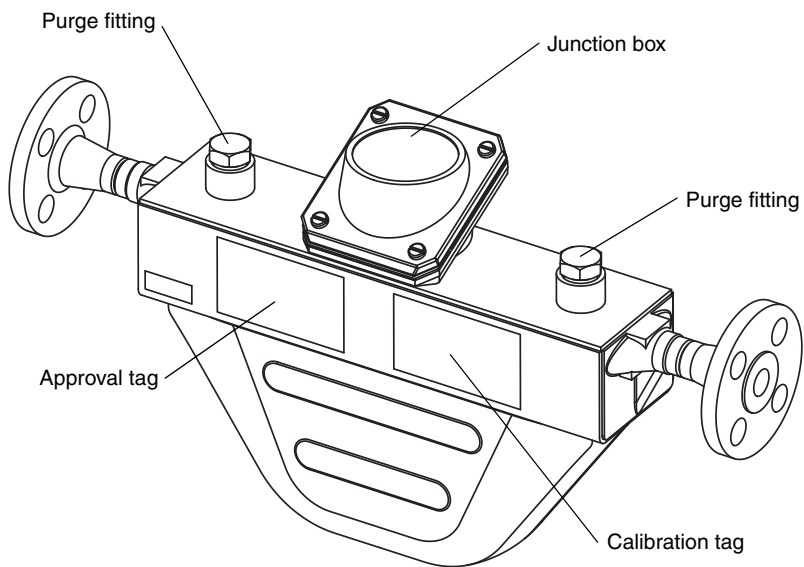


Figure 3 F-Series sensor with junction box

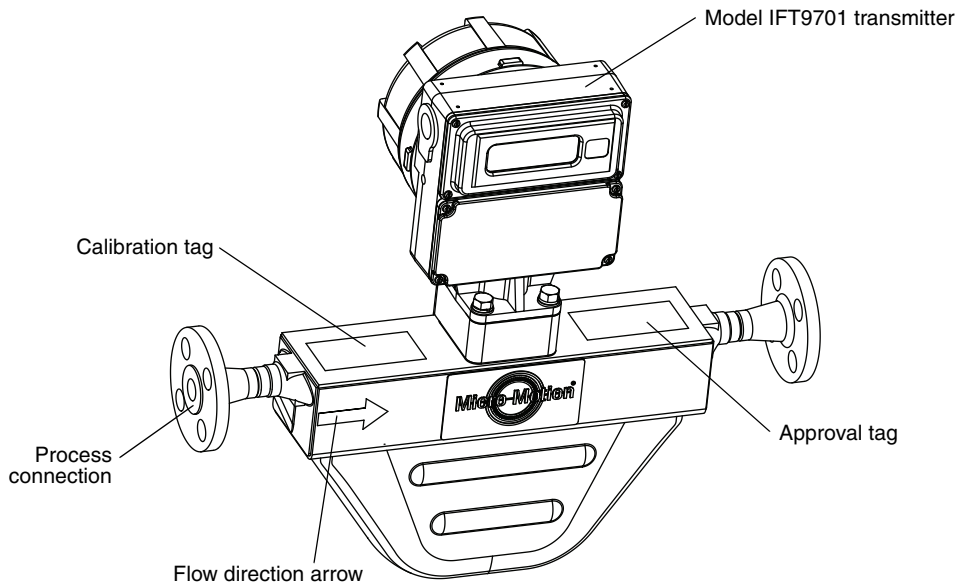


Sensor with purge fittings



Before You Begin

Figure 4 F-Series sensor with integrally mounted IFT9701 transmitter



Sensor with purge fittings

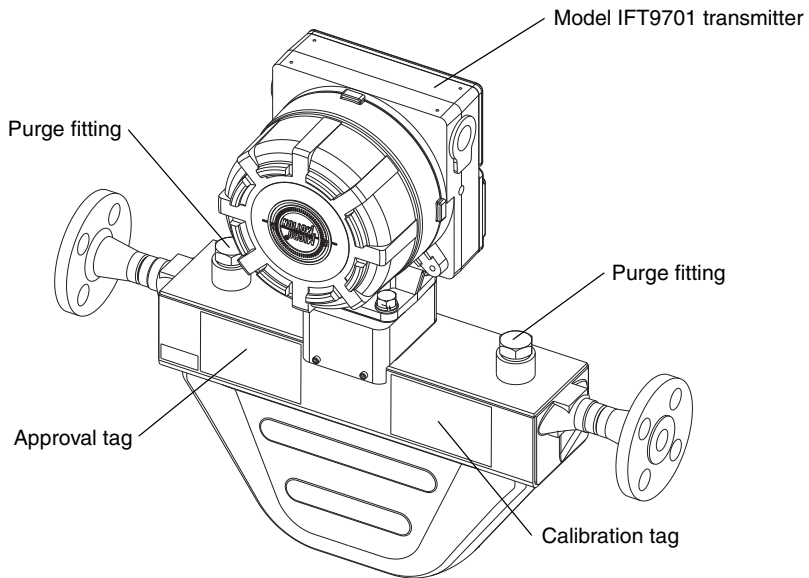
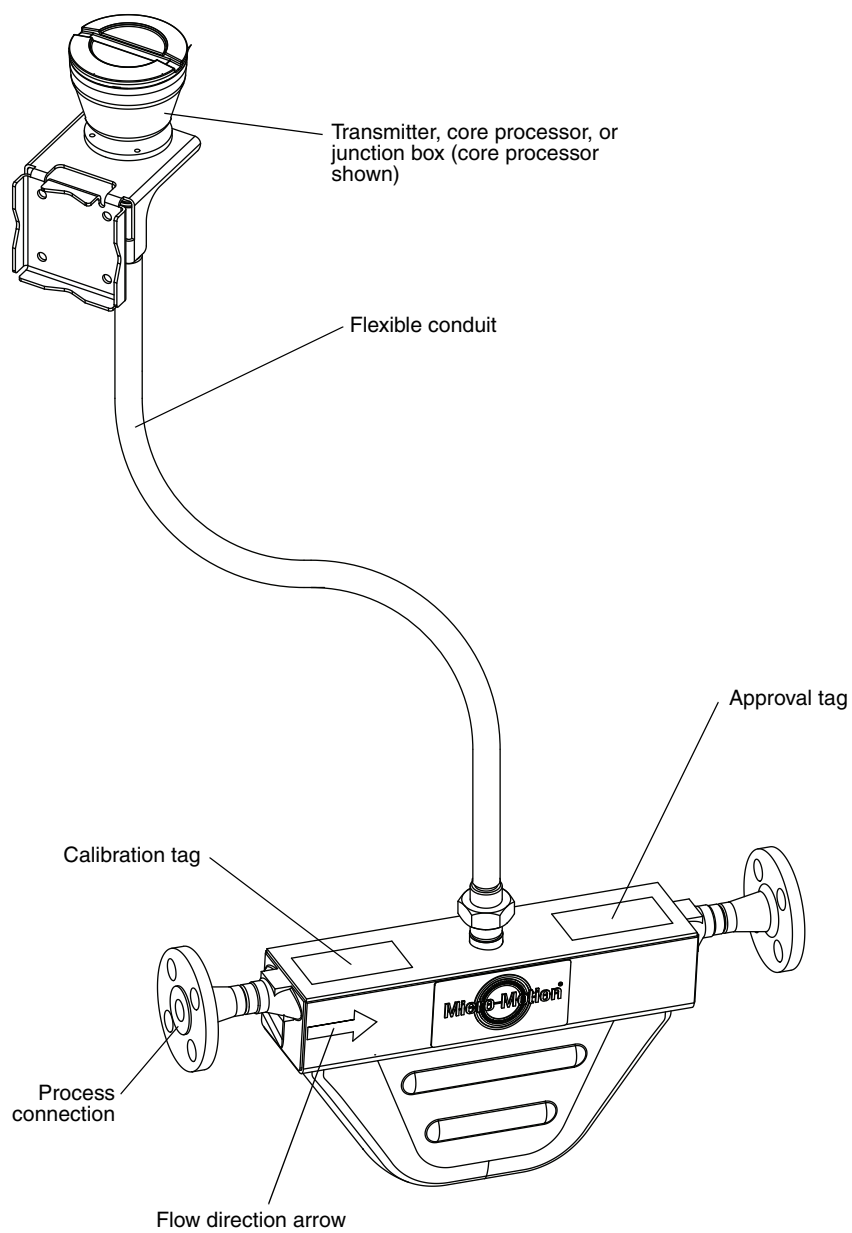


Figure 5 High-temperature or extreme high-temperature F-Series sensor with flexible conduit



Step 1 Determining a Location

Choose a location for the sensor based on the requirements described in this section. The following general guidelines can help you select an appropriate location for the sensor.

Full flow tubes

For optimal performance, the sensor tubes should remain full of process fluid.

Hazardous area installations

Make sure the hazardous area specified on the sensor approval tag is suitable for the environment in which the sensor is installed (see Figures 1–5). For installation in an area that requires intrinsic safety, refer to the appropriate Micro Motion approval documentation, shipped with the sensor or available from the Micro Motion web site at www.micromotion.com.



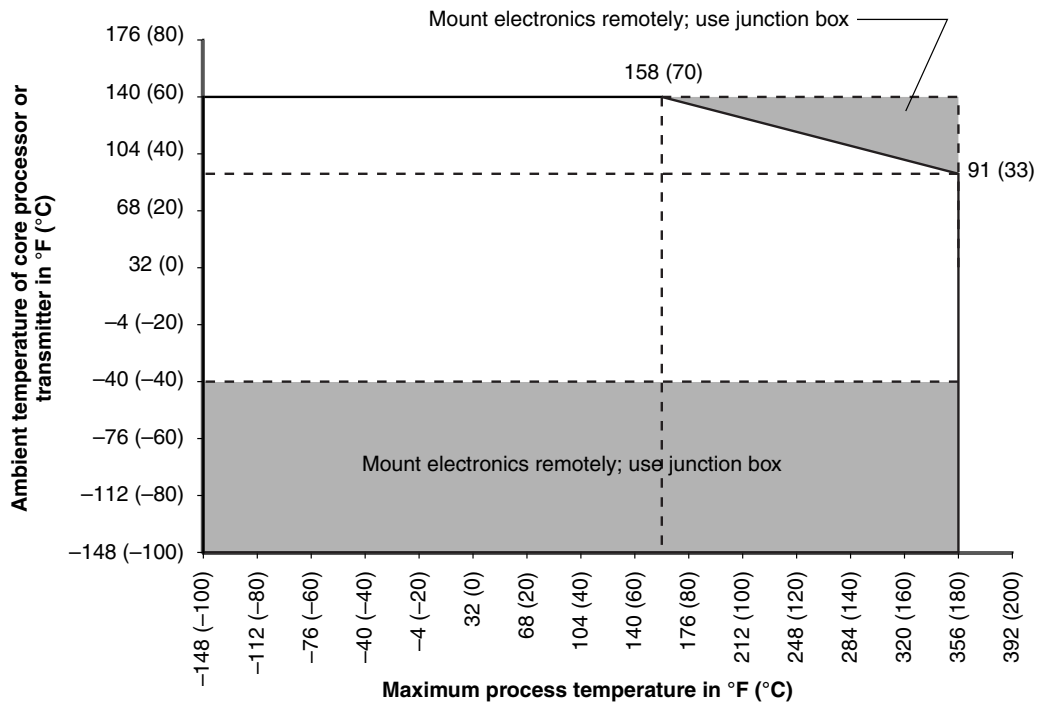
Improper installation in a hazardous area can cause an explosion. When installing in a hazardous area, refer to Micro Motion approvals instructions, shipped with the product or available from the Micro Motion web site. For hazardous installations in Europe, refer to standard EN 60079-14 if national standards do not apply.

Environmental limits

The ambient and process temperature limits of the sensor are shown in Figures 6 and 7:

- For F-Series sensor models *other* than high-temperature and extreme-high temperature models, see Figure 6.
- For high-temperature and extreme high-temperature F-Series sensors, see Figure 7.

Figure 6 F-Series sensor ambient and process temperature limits (all models *except* high-temperature and extreme high-temperature models)

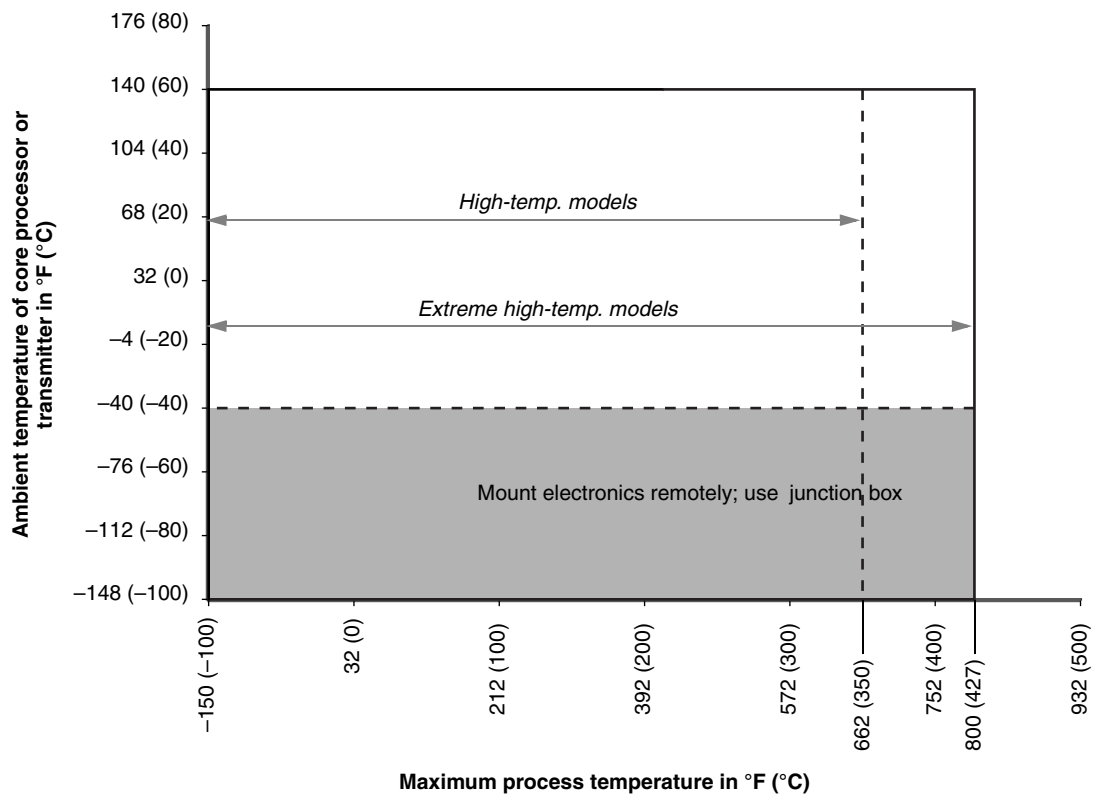


Notes:

1. When ambient temperature is below $-40\text{ }^{\circ}\text{F}$ ($-40\text{ }^{\circ}\text{C}$), a core processor must be heated to bring its local ambient temperature to between $-40\text{ }^{\circ}\text{F}$ ($-40\text{ }^{\circ}\text{C}$) and $+140\text{ }^{\circ}\text{F}$ ($+60\text{ }^{\circ}\text{C}$). Long-term storage of electronics at ambient temperatures below $-40\text{ }^{\circ}\text{F}$ ($-40\text{ }^{\circ}\text{C}$) is not recommended.
2. Temperature limits may be further restricted by hazardous area approvals.
3. The temperature extender option allows the sensor case to be insulated without covering the transmitter, core processor, or junction box, but does not affect temperature ratings.

Determining a Location

Figure 7 F-Series sensor ambient and process temperature limits (high-temperature and extreme high-temperature models)



Notes:

1. When ambient temperature is below $-40\text{ }^{\circ}\text{F}$ ($-40\text{ }^{\circ}\text{C}$), a core processor must be heated to bring its local ambient temperature to between $-40\text{ }^{\circ}\text{F}$ ($-40\text{ }^{\circ}\text{C}$) and $+140\text{ }^{\circ}\text{F}$ ($+60\text{ }^{\circ}\text{C}$). Long-term storage of electronics at ambient temperatures below $-40\text{ }^{\circ}\text{F}$ ($-40\text{ }^{\circ}\text{C}$) is not recommended.
2. Temperature limits may be further restricted by hazardous area approvals.

Hazardous area approvals may impose additional limits on ambient and process temperature. For the ATEX “T” rating, refer to the ATEX documentation shipped with the sensor or available on the Micro Motion web site at www.micromotion.com. IECEx and NEPSI approvals also use the ATEX “T” rating. UL and CSA ambient temperature limits are listed in Table 1.

Table 1 UL and CSA ambient temperature limits

	Sensor models	Electronics	°F	°C
UL	F025, F050, F100, F200	Junction box or IFT9701 transmitter	-4 to +104	-20 to +40
CSA	All models except high-temperature or extreme high-temperature models	Junction box IFT9701 transmitter	+140 maximum	+60 maximum
		Core processor or Model 1700/2700 transmitter	-40 to +140	-40 to +60
	High-temperature and extreme high-temperature models	All options	-40 to +140	-40 to +60

Maximum wiring distances

If the transmitter is mounted remotely from the sensor, the maximum distance between the sensor and transmitter depends on cable type. See Table 2.

For high-temperature and extreme high-temperature F-Series sensors, note the following:

- For sensors with a Model 1700/2700 transmitter, the transmitter is considered to be integrally mounted on the sensor, so Table 2 does not apply.
- For sensors with a junction box or core processor, the limits in Table 2 apply only to the wiring between the junction box or core processor and a remotely mounted transmitter. The length of the flexible conduit on which the junction box or core processor is mounted does not need to be considered.

Table 2 Maximum cable lengths

Cable type	Wire size	Maximum length
Micro Motion 9-wire to an MVD transmitter or core processor	Not applicable	60 feet (20 meters)
Micro Motion 9-wire to all other transmitters	Not applicable	1000 feet (300 meters)
Micro Motion 4-wire	Not applicable	1000 feet (300 meters)
User-supplied 4-wire		
Power wires (VDC)	22 AWG (0,35 mm ²)	300 feet (90 meters)
	20 AWG (0,5 mm ²)	500 feet (150 meters)
	18 AWG (0,8 mm ²)	1000 feet (300 meters)
Signal wires (RS-485)	22 AWG (0,35 mm ²) or larger	1000 feet (300 meters)

Pipe run

Micro Motion sensors do not require a straight run of pipe upstream or downstream.

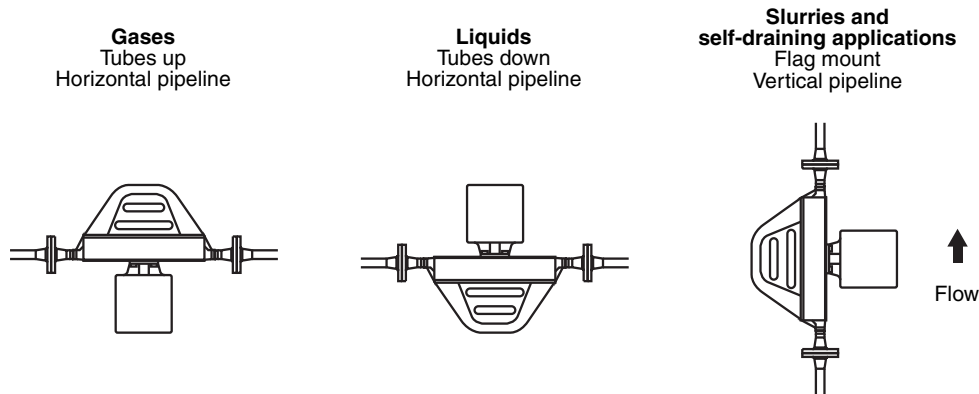
Valves

After the sensor and transmitter have been installed, you must perform the zeroing procedure. During the zeroing procedure, flow through the sensor must be halted and the sensor tubes must be completely full of process fluid. A shutoff valve, downstream from the sensor, is recommended to halt flow during the zeroing procedure. For more information about zeroing, refer to the instruction manual shipped with the transmitter.

Step 2 Orienting the Sensor

The sensor will function properly in any orientation if the sensor tubes remain filled with process fluid. Micro Motion recommends orienting F-Series sensors as shown in Figure 8.

Figure 8 Recommended sensor orientations



Self-draining applications

The F-Series sensor is self-draining when it is installed in a vertical pipeline (see Figure 8). For CIP applications it is recommended to use the generally accepted flow velocity of at least 1.5 m/sec for cleaning the sensor.

Flow direction arrow

The sensor has a flow direction arrow (see Figures 1–5) to help you configure the transmitter for flow direction. If possible, install the sensor so that the flow direction arrow matches actual process flow.

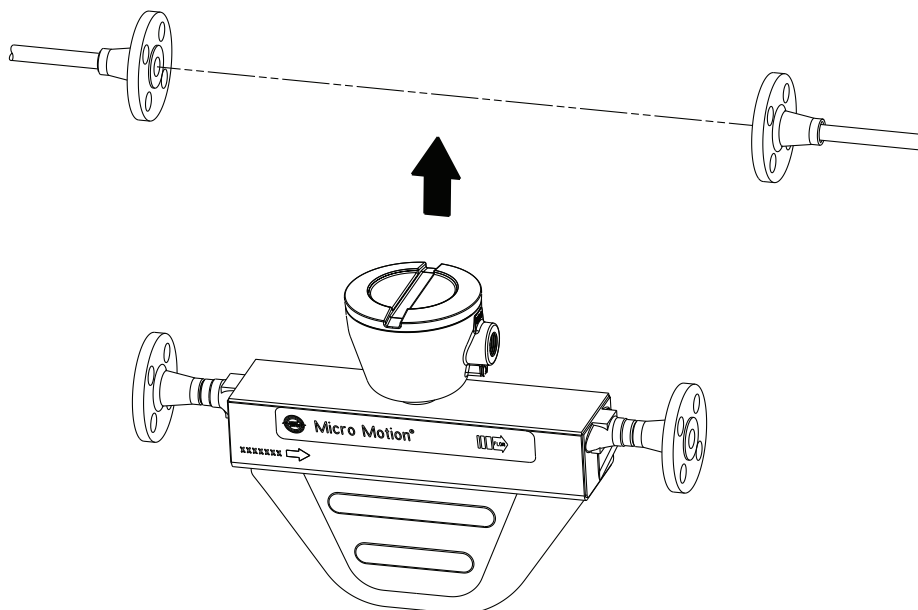
Vertical pipeline

If the sensor is installed in a vertical pipeline, liquids and slurries should flow upward through the sensor. Gases may flow upward or downward.

Step 3 Mounting the Sensor

Use your common practices to minimize torque and bending load on process connections. Figure 9 illustrates how to mount the sensor. To reduce the risk of condensation or excessive moisture, the conduit opening should not point upward (if possible). The conduit opening of the junction box or core processor can be rotated freely to facilitate wiring.

Figure 9 Mounting an F-Series sensor



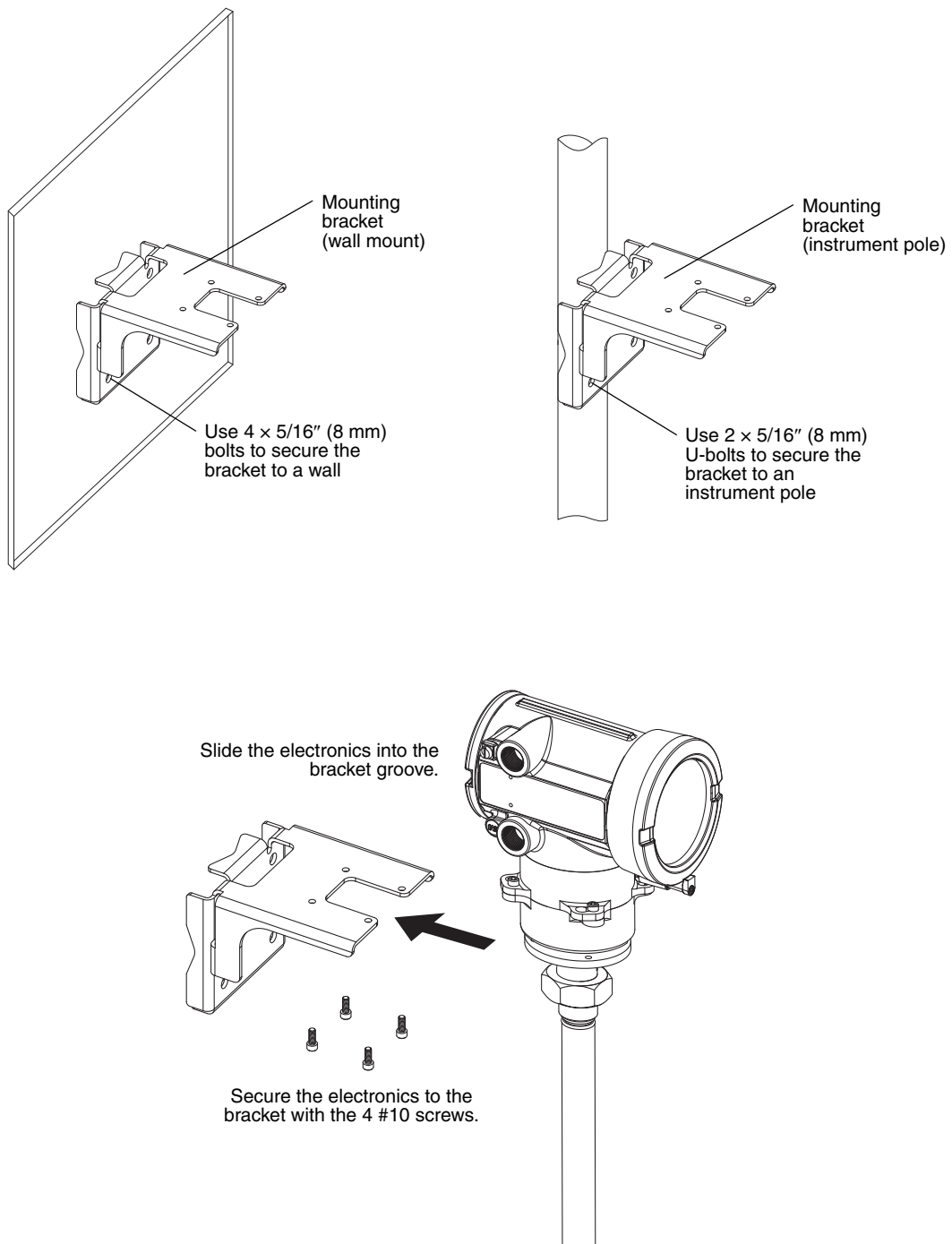
Mounting the Sensor

Mounting the electronics of high-temperature and extreme high-temperature sensors

High-temperature and extreme high-temperature F-Series sensors come with a 32" (812 mm) pre-installed flexible conduit. This conduit is required for agency approval.

A factory-supplied Model 1700/2700 transmitter, core processor, or junction box is connected to the end of the flexible conduit. Mount the electronics to a wall or instrument pole using the supplied bracket (Figure 10).

Figure 10 Electronics mounting for high-temperature F-Series sensors



Step 4 Wiring



Improperly sealed housings can expose electronics to moisture, which can cause measurement error or flowmeter failure. Inspect and grease all gaskets and O-rings. Fully close and tighten all housing covers and conduit openings.

Installation options

The sensor has one of the following electronics configurations:

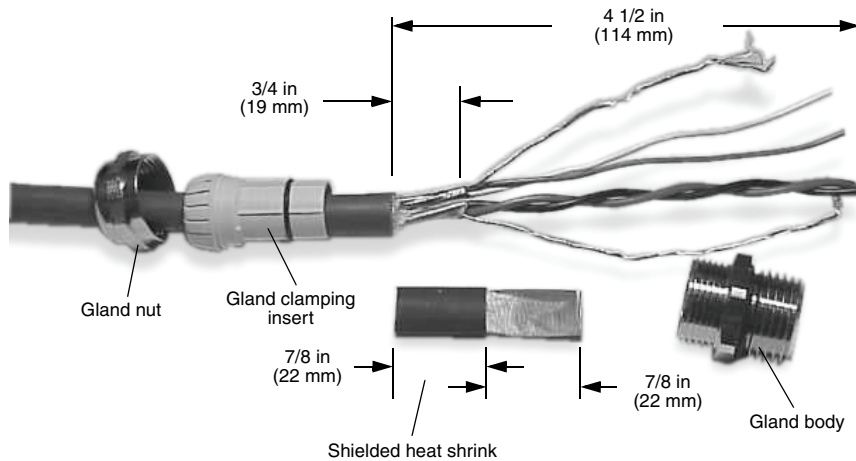
- An integral Model 1700/2700 or IFT9701 transmitter. No wiring is required between the sensor and the transmitter. Skip to *Grounding* on page 19.
- A core processor to a 4-wire remote transmitter (requires 4-wire cable); see *Core processor to a 4-wire remote transmitter*, below.
- A core processor to a remote host (requires 4-wire cable); refer to the *Micro Motion MVD™ Direct Connect™ Flowmeter Installation Manual*.
- A junction box to a 9-wire remote transmitter (requires 9-wire cable); see *Junction box to a 9-wire remote transmitter or remote core processor* on page 18.

Core processor to a 4-wire remote transmitter

Follow the steps below to connect the 4-wire cable between the core processor and the transmitter.

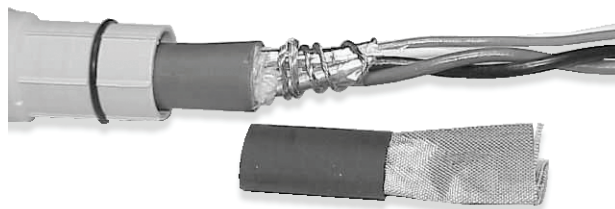
1. Use one of the following methods to shield the wiring from the core processor to the transmitter:
 - If you are installing unshielded wiring in continuous metallic conduit that provides 360° termination shielding for the enclosed wiring, go to page 17 (step 6 of the wiring procedure).
 - If you are installing a user-supplied cable gland with shielded cable or armored cable, terminate the shields in the cable gland. Terminate both the armored braid and the shield drain wires in the cable gland. Never connect the drain wires to the internal ground screw of the core processor. Go to page 17 (step 6 of the wiring procedure).
 - If you are installing a Micro Motion-supplied cable gland at the core processor housing:
 - Prepare the cable and apply shielded heat shrink as described below. The shielded heat shrink provides a shield termination suitable for use in the gland when using cable whose shield consists of foil and not a braid. Proceed to step 2 of the wiring procedure, below.
 - With armored cable, where the shield consists of braid, prepare the cable as described below, but do not apply heat shrink. Proceed to step 2 of the wiring procedure, below.
2. Remove the cover from the core processor housing.
3. Slide the gland nut and the clamping insert over the cable.

Figure 11 Micro Motion cable gland and heat shrink



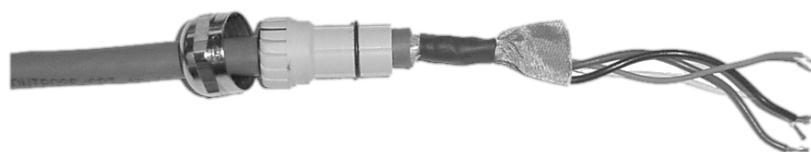
4. For connection at the core processor housing, prepare shielded cable as follows (for armored cable, omit steps d, e, f, and g):
 - a. Strip 4 1/2 inches (114 mm) of cable jacket.
 - b. Remove the clear wrap that is inside the cable jacket, and remove the filler material between the wires.
 - c. Remove the foil shield that is around the insulated wires, leaving 3/4 inch (19 mm) of foil or braid and drain wires exposed, and separate the wires.
 - d. Wrap the shield drain wire(s) around the exposed foil twice. Cut off the excess wire.

Figure 12 Wrapping the shield drain wires



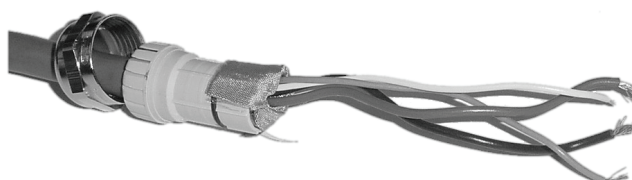
- e. Place the shielded heat shrink over the exposed shield drain wire(s). The tubing should completely cover the drain wires.
- f. Without burning the cable, apply heat (250 °F or 120 °C) to shrink the tubing.

Figure 13 Applying the heat shrink



- g. Position gland clamping insert so the interior end is flush with the heat shrink.
- h. Fold the cloth shield or braid and drain wires over the clamping insert and approximately 1/8 inch (3 mm) past the O-ring.

Figure 14 Folding the cloth shield



- i. Install the gland body into the core processor housing conduit opening.

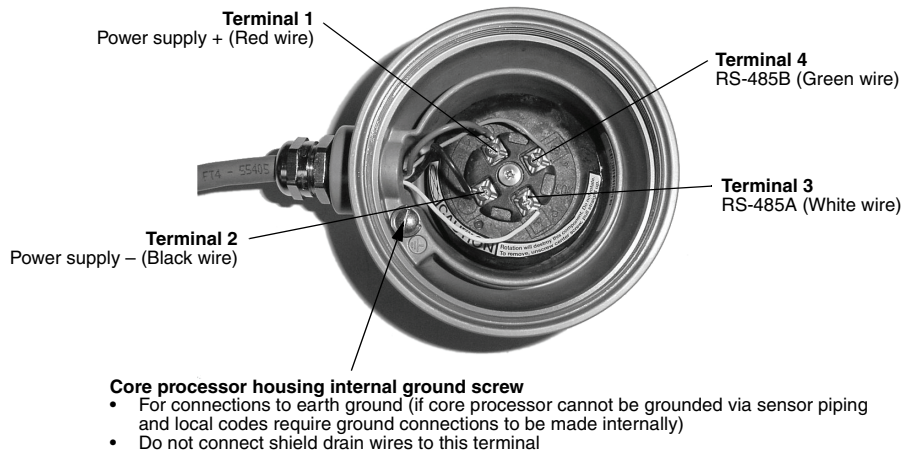
Figure 15 Gland body and core processor housing



5. Insert the wires through the gland body and assemble the gland by tightening the gland nut. If desired, leave sufficient wire length inside the core processor housing to allow the housing to rotate without damaging the wires.
6. Identify the wires in the 4-wire cable. The 4-wire cable supplied by Micro Motion consists of one pair of 18 AWG (0,80 mm²) wires (red and black), which should be used for the VDC connection, and one pair of 22 AWG (0,35 mm²) wire (green and white), which should be used for the RS-485 connection. Connect the four wires to the numbered slots on the core processor (Figure 16).

Wiring

Figure 16 Connecting the wires at the core processor



7. Reinstall and tighten the core processor housing cover.
8. Additional wiring instructions for the transmitter can be found in the transmitter manual.

Note: Never ground the 4-wire cable shield and shield drain wire(s) at the transmitter.

Junction box to a 9-wire remote transmitter or remote core processor

Follow the steps below to connect the 9-wire cable between the sensor and the transmitter or core processor.

1. Prepare and install the cable according to the instructions in Micro Motion's *9-Wire Flowmeter Cable Preparation and Installation Guide*.
2. Insert the stripped ends of the individual wires into the terminal blocks. No bare wires should remain exposed.
3. Match the wires color for color. For wiring at the transmitter or remote core processor, refer to the transmitter documentation.
4. Tighten the screws to hold the wires in place.
5. Ensure integrity of gaskets, then tightly close and seal the junction box cover and all housing covers on the transmitter or core processor.

Step 5 Grounding

The sensor can be grounded via the piping if the joints in the pipeline are ground-bonded. If the sensor is not grounded via the piping, connect a ground wire to the internal or external grounding screw, which is located on the core processor housing or junction box.



Improper grounding can cause measurement error. Ground the flowmeter to earth, or follow ground network requirements for the facility.

If national standards are not in effect, follow these guidelines to ground the sensor:

- Use copper wire, 14 AWG (2,0 mm²) or larger wire size for grounding.
- Keep all ground leads as short as possible, less than 1 ohm impedance.
- Connect ground leads directly to earth, or follow plant standards.

Pressure Ratings at High Temperatures

Table 3 shows the pressure ratings for F-Series sensors at high temperatures.

Table 3 F-Series pressure ratings at high temperatures

EN-1092 flange					Pressure rating (bar)									Note
PN	Type	Facing	Description	ASTM material	≤50°C	100°C	150°C	200°C	250°C	300°C	350°C	400°C	427°C	
40	11 weld neck	B1 & D	Flange, EN 1092-1 PN40 Forms B1 & D (316)	316	40.0	40.0	36.3	33.7	31.8	29.7	28.5	27.4	26.9	1
100	11 weld neck	B2 & D	Flange, EN 1092-1 PN100 Form B2 & D (316)	316	100.0	100.0	90.9	84.2	79.5	74.2	71.4	68.5	67.3	1
100/160	11 weld neck	B2	Flange, EN 1092-1 PN100/160 Form B2 (316)	316	100.0	100.0	90.9	84.2	79.5	74.2	71.4	68.5	67.3	2
					160.0	160.0	145.5	134.8	127.2	118.8	114.2	109.7	107.8	3
40	32/02 lap joint	B1	Flange, EN 1092-1 PN40 Form B1 (lap joint)	C-22 collar/304 flange	40.0	34.4	30.8	28.0	26.0	24.1	23.0	22.0	21.4	4

1. Pressure rating limited by flange (for 316 sensor tubes).
2. Pressure rating limited by sensor tube for sensor type F025S, F050S, F050A, F050C.
3. Pressure rating limited by flange for sensor type F025A, F025C, F025P, F050P.
4. Pressure rating limited by flange (for C-22 Alloy sensor tubes).

Purge Fittings

If the sensor has purge fittings, they should remain sealed at all times. After a purge plug has been removed, the sensor case should be purged with argon or nitrogen and resealed.

Purging the case protects internal components. The sensor is purged of all oxygen and sealed at the factory. If the purge plugs are never removed, it is not necessary to purge or re-seal the sensor. For more information, contact Micro Motion Customer Service.

Removing a purge plug

If a purge plug is removed from the sensor case, it will be necessary to repurge the case.



Removing a purge plug compromises the secondary containment of the sensor and could expose the user to process fluid. Take all necessary precautions when removing purge plugs.



Improper pressurization of the sensor case could result in personal injury. Removing a purge plug will require the sensor case to be repurged with a dry inert gas. Follow all instructions provided in the case purging procedure.

Case purging procedure

Read all instructions before performing the case purging procedure. It is not necessary to perform this procedure unless a purge plug has been removed.

1. Shut down the process, or set control devices for manual operation.



Performing the purge procedure while the flowmeter is operating could affect measurement accuracy, resulting in inaccurate flow signals. Before performing the case purging procedure, shut down the process, or set control devices for manual operation.

2. Remove both purge plugs from the sensor case. If purge lines are being used, open the valve in the purge lines.
3. Prepare the purge plugs for reinstallation by wrapping them with 3–5 turns of Teflon[®] tape.
4. Connect the supply of nitrogen or argon gas to the inlet purge connection or open inlet purge line. Leave the outlet connection open.
 - Exercise caution to avoid introducing dirt, moisture, rust, or other contaminants into the sensor case.
 - If the purge gas is heavier than air (for example, argon), locate the inlet lower than the outlet, so the purge gas will displace air from bottom to top.
 - If the purge gas is lighter than air (such as nitrogen), locate the inlet higher than the outlet, so the purge gas will displace air from top to bottom.
5. Make sure there is a tight seal between the inlet connection and sensor case, so air cannot be drawn by suction into the case or purge line during the purging process.
6. The purge time is the amount of time required for full exchange of atmosphere to inert gas. For each sensor size, the purge time is different. Refer to Table 4. If purge lines are being used, increase the purge time to fill the additional volume of the purge line.
7. Avoid pressurizing the sensor case. At the appropriate time, shut off the gas supply, then immediately seal the purge outlet and inlet connections with the purge plugs. If pressure inside the case elevates above atmospheric pressure during operation, the flowmeter density calibration will be inaccurate.

Table 4 Time required to purge F-Series sensor cases

Sensor model	Purge rate ft³/hr (l/hr)	Time⁽¹⁾ minutes
F025	20 (566)	4 1/2
F050	20 (566)	4 1/2
F100	20 (566)	6
F200	20 (566)	15
F300	20 (566)	25

(1) If purge lines are being used, increase purge time to fill the additional volume.

8. Make sure the purge fitting seals are tight so air cannot be drawn by suction into the sensor case.

Return Policy

Micro Motion procedures must be followed when returning equipment. These procedures ensure legal compliance with government transportation agencies and help provide a safe working environment for Micro Motion employees. Failure to follow Micro Motion procedures will result in your equipment being refused delivery.

Information on return procedures and forms is available on our web support system at www.micromotion.com, or by phoning the Micro Motion Customer Service department.

New and unused equipment

Only equipment that has not been removed from the original shipping package will be considered new and unused. New and unused equipment requires a completed Return Materials Authorization form.

Used equipment

All equipment that is not classified as new and unused is considered used. This equipment must be completely decontaminated and cleaned before being returned.

Used equipment must be accompanied by a completed Return Materials Authorization form and a Decontamination Statement for all process fluids that have been in contact with the equipment. If a Decontamination Statement cannot be completed (e.g., for food-grade process fluids), you must include a statement certifying decontamination and documenting all foreign substances that have come in contact with the equipment.

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